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Fabrication of the catalyst free GaN nanorods on Si grown by MOCVD

Suk-min Ko, Yong-Hoon Cho

Department of Physics and Graduate School of Nanoscience & Technology (WCU),
Korea Advanced Institute of Science and Technology (KAIST)

Recently light emitting diodes (LEDs) have been expected as the new generation light sources because of their advantages such as small size, long lifetime and energy-saving. GaN, as a wide band gap material, is widely used as a material of LEDs and GaN nanorods are the one of the most widely investigated nanostructure which has advantages for the light extraction of LEDs and increasing the active area by making the cylindrical core-shell structure. Lately GaN nanorods are fabricated by various techniques, such as selective area growth, vapor-liquid-solid (VLS) technique. But these techniques have some disadvantages. Selective area growth technique is too complicated and expensive to grow the rods. And in the case of VLS technique, GaN nanorods are not vertically aligned well and the metal catalyst may act as the impurity. So we just tried to grow the GaN nanorods on Si substrate without catalyst to get the vertically well aligned nanorods without impurity. First we deposited the AlN buffer layer on Si substrate which shows more vertical growth mode than sapphire substrate. After the buffer growth, we flew trimethylgallium (TMGa) as the III group source and ammonia as the V group source. And during the GaN growth, we kept the ammonia flow stable and periodically changed the flow rate of TMGa to change the growth mode of the nanorods. Finally, as the optimization, we changed the various growth conditions such as the growth temperature, the working pressure, V/III ratio and the doping level. And we are still in the process to reduce the diameter of the nanorods and to extend the length of the nanorods simultaneously. In this study, we focused on the shape changing of GaN nanorods with different growth conditions. So we confirmed the shape of the nanorods by scanning electron microscope (SEM) and carried out the Photoluminescence (PL) measurement and x-ray diffraction (XRD) to examine the crystal quality difference between samples. Detailed results will be discussed.